Width of Littoral Vegetation Beds Relative to Channel Morphology

Expectation:	Mean width of littoral vegetation beds in restored river channels will decrease to: i) three meters or less from the bank on outer channel bends. ii) five meters or less from the bank on inner channel bends. iii) three to five meters from the bank on straight channel reaches.
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Relevant Endpoints:	Sociopolitical - Navigation Sociopolitical - Aesthetic Values Restoration - System Functional Integrity - Habitat Diversity Restoration - System Functional Integrity - Habitat Quality

Reference Condition:

Qualitative analysis of in-channel vegetation cover prior to construction of canal C-38 was based on June 1956 black and white aerial photography (1:12000). Although a distinct littoral zone is difficult to distinguish from broadleaf marsh and other floodplain vegetation, width of littoral vegetation beds clearly was greatest on inner channel bends. Vegetation beds on inner bends tended to be at least twice as wide as on outer bends, where vegetation was often almost non-existent. Widths of vegetation beds on either side of straight channel reaches appeared roughly equal, but not as wide as on inner bends.

Reference conditions for prediction of post-restoration vegetation bed widths were based primarily on a June 1998 field survey of littoral vegetation (L. Carnal, unpublished data) in a semi-restored river channel in Pool B (Toth 1991) which had been exposed to reestablished flow for six-nine months (Figure 1). These data provide an indication of probable vegetation characteristics following restoration, although they may not represent a fully restored system (Toth 1991). Flow was diverted to the channel by a weir across C-38 (Toth 1991). Only littoral beds delineated on the aerial photographs were measured in the 1998 survey, and bends without vegetation were not included in calculations of mean bed width. This methodology probably resulted in inflated means compared to that used in baseline surveys, particularly along outer channel bends, which may lack vegetation. Mean widths of vegetation beds in the 1998 survey were 3.8 ± 0.5 m on outer channel bends, 5.0 ± 0.4 m on inner bends, and 3.6 ± 0.6 m on straight reaches (Figure 2).

Baseline Condition:

Dense vegetation beds of *Nuphar lutea*, *Scirpus cubensis*, and other aquatic species commonly extend well into mid-channel areas of the remnant river, and floating species such as *Pistia stratiotes* may cover the entire width of the channel in runs with no flow that are not treated with herbicides.

Transects were established in Pool A (control area) and Pools B and C (impact area) to sample baseline conditions for detection of changes resulting from restored flow. Sampling was conducted in 1998 and 1999 in February-March (dry season), except in 1998, when dry season sampling extended into May; and in August-September (wet season). Baseline surveys of river channel vegetation beds were conducted along 93 one-meter wide belt transects at systematically-selected bends and straight reaches of remnant river channels. Vegetation bed widths were measured along the transects from the bank to the waterward edge of the bed, and were classified by channel morphology (inner bend, outer bend, or straight).

Vegetation covers a mean of 78.6 ± 1.8 (one standard error)% of total channel width in the control area, and 64.3 ± 1.4% of total channel width in the impact area. Mean widths of littoral vegetation beds in the impact study area were 7.5 ± 0.4 m on outer channel bends, 12.5 ± 0.5 m on inner bends, and 11 ± 0.4 m on straight reaches (Figure 2). Mean widths of vegetation beds in the control area were 9.8 ± 0.5 m on outer bends, 12.4 ± 0.5 m on inner bends, and 15.0 ± 0.6 m on straight reaches. Mean widths of vegetation beds in both the control and impact areas varied significantly ($p<0.05$) with channel morphology (Table 1).

Mechanism for Achieving Expectation: Restoration of continuous flow through river channels will limit the width of littoral vegetation beds. Widths will be determined by flow regimes that will vary with channel morphology. Initial high flows through the river channel will remove much of the mid-channel vegetation. Continuous flow will preclude reestablishment of invasive species such as *Pistia stratiotes*, and will limit the distribution of mat-forming species such as *Scirpus cubensis.*

Adjustment for External Constraints: Although reestablishment of continuous flow will reduce cover of floating species such as *Pistia stratiotes* and *Eichhornia crassipes*, flow may not be sufficient to completely eliminate these exotic species and their associated mats, particularly during periods of low discharge. *Hydrilla verticillata* will likely sustain minimal impact from high or continuous flow. To maintain navigation during periods of low flow it may be necessary to periodically control these nuisance species by herbicide treatments.

Means of Evaluation: Evaluation of post-restoration success will begin in February-March 2000. Although Phase 1 of C-38 backfilling will not be complete at this time, the lower river runs of Pool C will be evaluated to track progression of littoral bed change following restoration. Post-restoration sampling methodology will be identical to baseline sampling. Sampling will continue semi-annually for at least two years. The sampling schedule will be coordinated with herbicide spray activities to avoid recording data on vegetation affected by herbicide treatments.

Statistical tests to determine whether expectations have been met will be assessed for statistical significance at $\alpha=0.05$.

Time Course: Initially, sufficiently high flows will be needed remove mid-channel vegetation; subsequently, flow must be sustained so that a new distribution of vegetation can be maintained. This is expected to occur within one to three years of backfilling and restored flow (Toth 1995).

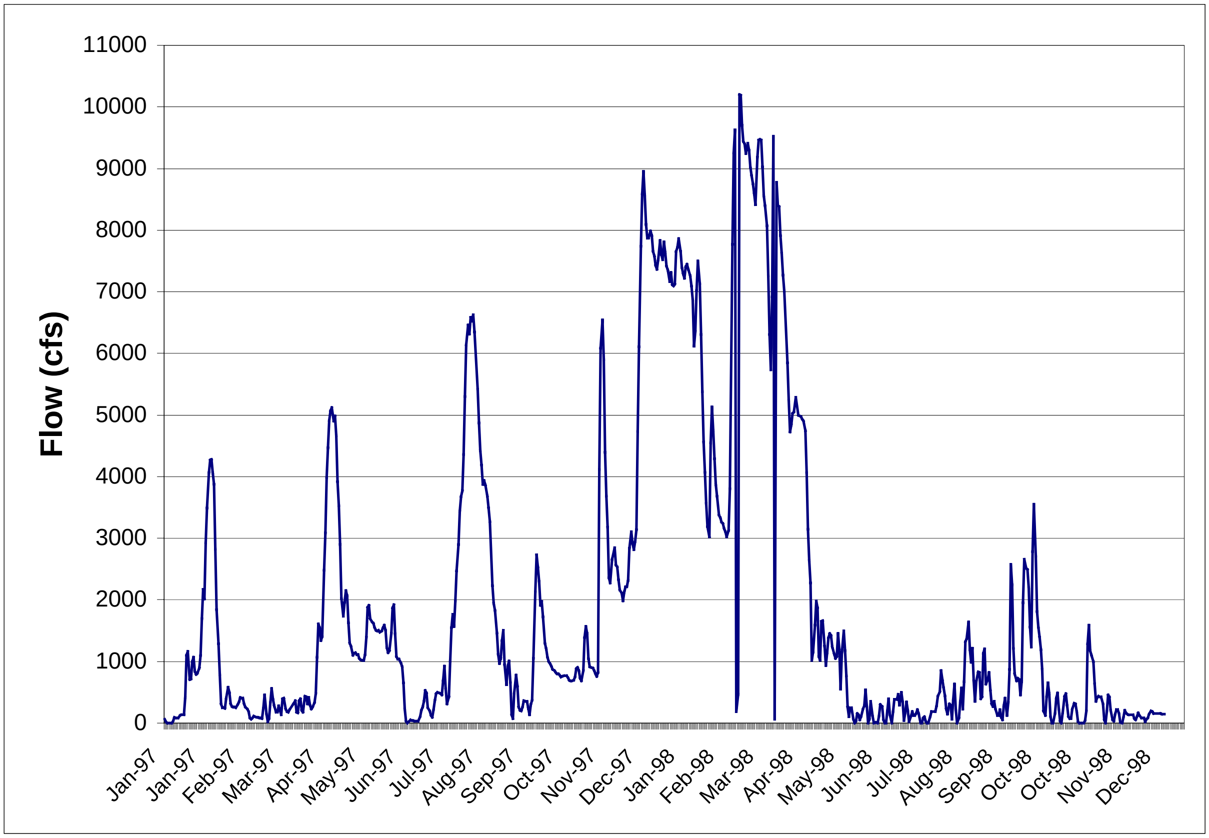

Figure 1. Discharge at S65-B, 1997-1998. Data from SFWMD 2001.

Figures 2a-c. Mean widths of vegetation beds along a remnant river channel with reestablished flow (Reference), and along remnant river channels in the impact study area (Pools B and C, Baseline). Error bars indicate ± one standard error of the mean.

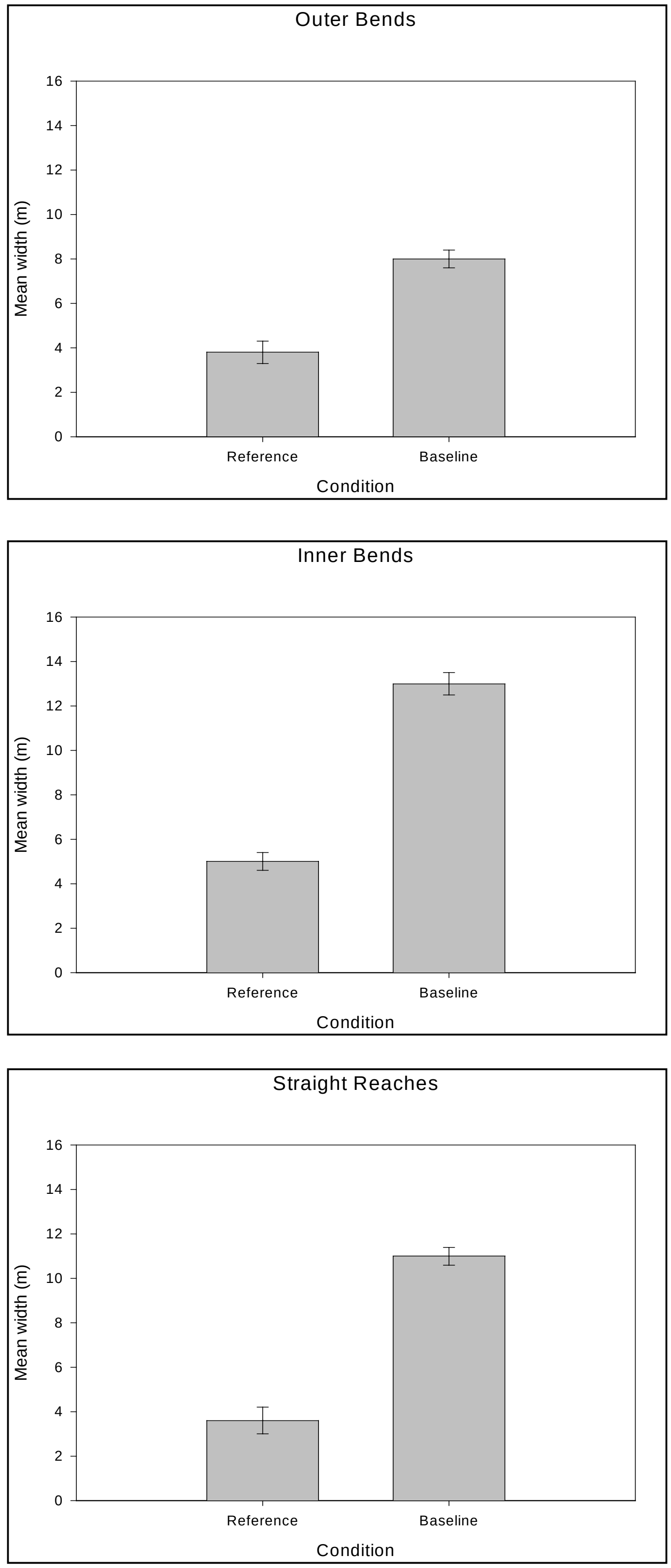

Table 1. Comparison of mean width (m) (± one standard error) of vegetation beds on inner and outer bends and straight reaches of remnant river channels in the impact (Pools B and C) and control (Pool A) areas (Kruskal-Wallis test, $p < 0.05$). Dunn's test was used to separate multiple comparisons. Different letters following the mean value within impact and control areas indicate that vegetation bed widths were significantly different.

Impact	
	Width (m)
Inner	12.5 ± 0.5 a
Outer	7.5 ± 0.4 c
Straight	11.0 ± 0.4 b

Control	
	Width (m)
Inner	12.4 ± 0.5 b
Outer	9.8 ± 0.5 c
Straight	15.0 ± 0.6 a

References

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